CLAIMS:

1. An optical scanning device (1) for scanning a first information layer (2") by means of a first radiation beam (4") having a first wavelength (λ_3) and a first polarization (p_3), a second information layer (2) by means of a second radiation beam (4) having a second wavelength (λ_1) and a second polarization (p_1), and a third information layer (2') by means of a third radiation beam (4') having a third wavelength (λ_2) and a third polarization (p_2), wherein said first, second and third wavelengths substantially differ from each other, the device comprising:

a radiation source (7) for emitting said first, second and third radiation beams consecutively or simultaneously,

an objective lens system (8) for converging said first, second and third radiation beams beam on the positions of said first, second and third information layers, and

a phase structure (24) with a non-periodic stepped profile, arranged in the optical path of said first, second and third radiation beams, the structure including a plurality of steps (j) with different heights (h_j) for forming said non-periodic stepped profile, characterised in that:

said phase structure (24) includes birefringent material sensitive to said first, second and third polarizations (p_3, p_1, p_2) and

said stepped profile is designed for introducing a first wavefront modification (ΔW_3), a second wavefront modification (ΔW_1) and a third wavefront modification (ΔW_2) for said first, second and third wavelengths (λ_3, λ_1, λ_2), respectively, wherein at least one of said first, second and third wavefront modifications is of a type different from the others and at least one of said first, second and third polarizations (p_3, p_1, p_2) differs from the others.

2. An optical scanning device (1) according to Claim 1, wherein said first wavefront modification (ΔW_3) is substantially of the type(s) of spherical aberration and/or defocus.

3. An optical scanning device (1) according to Claim 1 or 2, wherein said second wavefront modification (ΔW_1) is substantially flat.

4. An optical scanning device (1) according to Claim 3, wherein said third wavefront modification (ΔW_2) is substantially flat.

5. An optical scanning device (1) according to Claim 4, wherein said stepped profile is further designed for introducing substantially identical phase changes ($\Delta\Phi_1$, $\Delta\Phi_2$) for both said second and third wavelengths (λ_1, λ_2), and wherein said third polarisation (p_2) differs from said second polarisation (p_1).

6. An optical scanning device (1) according to Claim 5, wherein the extraordinary refractive index (n_e) of said birefringent material substantially equals $1+\frac{\lambda_c}{\lambda_b}(n_o-1)$, where "$n_o$" is the ordinary refractive index of said birefringent and "λ_b" and "λ_c" are either said second and third wavelengths (λ_1, λ_2), respectively, or said third and second wavelengths (λ_2, λ_1), respectively.

7. An optical scanning device (1) according to Claim 3, wherein said third wavefront modification (ΔW_2) is substantially of the same type as said first wavefront modification (ΔW_3).

8. An optical scanning device (1) according to Claim 7, wherein said stepped profile is further designed for introducing substantially identical phase changes ($\Delta\Phi_2$, $\Delta\Phi_3$) for both said first and third wavelengths (λ_3, λ_2), and wherein said third polarisation (p_2) differs from said first polarisation (p_3).

9. An optical scanning device (1) according to Claim 8, wherein the extraordinary refractive index (n_e) of said birefringent material substantially equals $1+\frac{\lambda_c}{\lambda_b}(n_o-1)$, where "$n_o$" is the ordinary refractive index of said birefringent and "λ_b" and "λ_c" are either said first and third wavelengths (λ_3, λ_2), respectively, or said third and first wavelengths (λ_2, λ_3), respectively.

10. An optical scanning device (1) according to Claim 1, wherein said heights (h_j) are further designed such that the relative step heights (h_{j+1}-h_j) between adjacent steps (j, j+1) include a relative step height having an optical path substantially equal to $a\lambda_1$, wherein "a" is an integer and a>1 and "λ_1" is said second wavelength.

11. An optical scanning device (1) according to Claim 1, wherein said phase structure (24) is generally circular and said steps (j) are generally annular.

12. An optical scanning device (1) according to Claim 1, wherein said phase structure (24) is formed on a face of a lens of said objective lens system (8).

13. An optical scanning device (1) according to Claim 1, wherein said phase structure (24) is formed on an optical plate provided between said radiation source (7) and said objective lens system (8).

14. An optical scanning device according to Claim 13, wherein said optical plate comprises a quarter wavelength plate or a beam splitter.

15. A phase structure (24) for use in an optical scanning device (1) for scanning a first information layer (2") by means of a first radiation beam (4") having a first wavelength (λ_3) and a first polarization (p_3), a second information layer (2) by means of a second radiation beam (4) having a second wavelength (λ_1) and a second polarization (p_1), and a third information layer (2') by means of a third radiation beam (4') having a third wavelength (λ_2) and a third polarization (p_2), wherein said first, second and third wavelengths substantially differ from each other, the structure being arranged in the optical path of said first, second and third radiation beams and having a non-periodic stepped profile, characterised in that:

said phase structure (24) includes birefringent material sensitive to said first, second and third polarizations (p_3, p_1, p_2) and

said stepped profile is designed for introducing a first wavefront modification (ΔW_3), a second wavefront modification (ΔW_1) and a third wavefront modification (ΔW_2) for said first, second and third wavelengths (λ_3, λ_1, λ_2), respectively, wherein at least one of said

first, second and third wavefront modifications is of a type different from the others and at least one of said first, second and third polarizations (p_3, p_1, p_2) differs from the others.

16. A lens (17) for use in an optical scanning device (1) for scanning a first information layer (2") by means of a first radiation beam (4") having a first wavelength (λ_3) and a first polarization (p_3), a second information layer (2) by means of a second radiation beam (4) having a second wavelength (λ_1) and a second polarization (p_1), and a third information layer (2') by means of a third radiation beam (4') having a third wavelength (λ_2) and a third polarization (p_2), wherein said first, second and third wavelengths substantially differ from each other, the lens being provided with a phase structure according to Claim 15.